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Methods and Scope of Natural Object Teaching in the Medical School

BY GEORGE S. HUNTINGTON

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METHODS AND SCOPE OF NATURAL OBJECT TEACHING IN THE MEDICAL SCHOOL*

BY

GEORGE S. HUNTINGTON

In August of this year, from the nineteenth to the twenty-third of the month, the Seventh International Zoological Congress, composed of representatives from all parts of the world, met in Boston, in the first gathering held on this side of the Atlantic. It is a matter of national satisfaction and pride that the place selected for the chief meeting could offer to the visitors, for inspection and study, a monument to the genius and foresight of one of the great men which this country has produced. The visit of the Congress to the Agassiz Museum, at Cambridge, constituted one of the most impressive and interesting events of the entire meeting, offering the outward and visible evidence of its founder's intention when he wrote "Study nature, not books."

We have met here today to formally open the one hundred and first academic session of this institution. The dean has greeted, in behalf of the school, the men who have assembled to take up another year of medical work, and has bid welcome to those who today begin their professional life. It has fallen to my lot to address you on some topic bearing on the work you are about to undertake and prosecute during the coming academic year. It seems to me that I can best fulfill this office if I draw your attention to the practical application, in your own individual cases, of the great educational principle which underlies the words of Agassiz, just quoted, "Study nature, not books." For in the very broadest and highest sense you are students of nature, and will remain such all through your professional life, if that life is to reach its full maturity and produce its best fruits. A consideration of the "Methods of natural object study" implies, it seems to me, in our particular case the analysis, on one hand,

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of the opportunities which this school offers to you, both in direct instruction and in facilities for self-study, and, on the other, calls for a clear understanding of your own individual attitude and obligation towards these opportunities, and a definite determination of the amount and direction of the effort which you are called upon to make in response to the stimulus received from the school at large.

Let us recognize at the very outset that the study of medicine, in spite of the complexity and versatility of the profession of today, resolves itself into the correct grasp of one natural object, the human body, but includes that object in all of its multiple relations to its environment. You are required to know man's morphology, and the biochemical and physiological conditions under which he exists normally. You will reason concerning his structural modifications and recognize in them adaptations to normal functions. You will be called upon to study the structural deviations produced by injury, disease or variation, and to interpret accordingly the resulting disturbances of function and of vital phenomena. Wherever you turn, no matter which of the many side-paths branching out from the main line of your profession you follow, everywhere will you meet with the necessity of close and accurate observation of organic conditions, structural and functional, chemical and physical, normal and aberrant. In every case you are called upon to accurately record and keenly interpret these observations, and to finally assemble them for broader interpretation and generalization in one of the many directions of modern professional activity. There exists no real difference in the method of observation and in the resultant mental processes leading to valid conclusions, no matter how widely divergent the actual objects of your study are. A chemical or bacteriological analysis, the accurate determination of the components of a brachial plexus, the effect of certain drugs or of the division or stimulation of certain nerves on vascular pressure, the examination of a fractured thigh, with its problems of muscular action and its physical causes of displacement and deformity, the correct mapping out of the area involved in a lobar pneumonia, all these, and many other conditions which you are required to meet in the

course of your undergraduate study and your subsequent professional work, call for the examination of natural objects and for the establishment of conclusions based on the results of such examination. That is one of the meanings of the injunction "Study nature, not books." No amount of reading, no development of memory, no accumulation of facts gleaned from the observations of others—important as all these aids are in their proper place—can ever render you fit to cope with the actual problems you will encounter, unless your eye and hand and ear have been so trained by practical experience that the impressions received will direct your mental processes into the right channels and enable you to formulate correct and complete conclusions.

This is the problem which presents itself to the school at the outset in its endeavor to teach properly and successfully. In the real meaning of this problem it is not primarily a question of imparting to you an orderly collection of abstract morphological, chemical, clinical or physiological facts, it is the vastly more fundamental and vital demand for methods which will teach you *how* to study nature, how to train your perceptions and your way of receiving and interpreting them in a direction and to a degree which will fit you after entering upon your active professional life to carry on the ceaseless study which that life demands, to advance knowledge on your own account, to intelligently keep on the crest of the wave produced by the efforts of others. Now, from the practical educational standpoint, there are two conditions of importance which concern you personally.

In the first place there is the well-recognized individual difference in the rapidity, ease and correctness with which mechanical conditions are appreciated, retained and correlated in the mental picture of the whole. You are called upon, for instance, at the very outset of your course to become thoroughly and intimately acquainted with the general organization and detailed structure of the machine, whose functional activity is to become your next main theme of study. These great primary topics mastered, you are called upon to consider the various conditions producing disability of this complex physical mechanism, the resulting loss of function and misdirection of energy, and the proper methods of

repair and restoration. In a general way your educational problems are similar to those encountered by men entering upon the study of mechanical engineering, with one important difference: your difficulties are vastly augmented by the fact that your machine is of infinite complexity and your structural unit not the constant and rigid molecule of metal, but the vital and ever-changing animal cell. Moreover, there are no spare parts to your machine, nor are they interchangeable. Your mechanical engineer can replace a cracked crank-shaft or a defective cylinder-head with a duplicate of the same casting at his leisure. You are required to keep your engine intact in its vital parts and to make your repairs while it is performing the absolutely necessary work. It is true that your welding and riveting and splicing and oiling of this complicated machine is constantly becoming more skilful, more daring, more careful and complete. Procedures that a few decades ago would have been regarded as visionary dreams are now almost daily occurrences in ordinary medical and surgical practice. The serous membranes no longer bear the stamp of "*noli me tangere.*" The abdominal viscera have taken kindly to almost any kind of readjustment. The surgical plumber of former days has become the expert sanitary engineer of the intestinal canal, cuts out defective pipe, introduces traps, anastomoses, transplants with a thoroughness and a degree of success which augurs much for the future. The range of mechanical relief and cure in the field of the central nervous system is constantly enlarging—even the thorax is becoming approachable—and it would take a bold prophet to predict where the advance will ultimately be arrested. When we see, as we did, *e. g.*, last year in the laboratory of experimental surgery, kidneys transplanted from one to the other animal, and sections of one abdominal aorta replacing excised portions in another individual, our faith in the possibility of almost unlimited progress must remain very firm. You are among the agents who will be responsible for your share in this advance, and you must realize that it calls for constantly increased requirements on your part in skill, deftness, rapidity of action and judgment, and complete knowledge of your subject. These are the qualities which your course in the medical school should

help you to develop and foster, if it is to answer its highest purpose. Now the task of organizing instruction in natural object study with this purpose in view for relatively large groups of men, meets, as I have said, with the personal equation of the student, with the variation in the receptive power and rapidity of assimilation of the individual. It is a very common observation that among men of various occupations and equal degrees of mentality, the faculty of correctly grasping space-conditions and mechanical concepts varies greatly. We speak of it as the "mathematical or mechanical mind." You might suppose the case, we will say, of two lawyers, equally brilliant, equally eloquent, equally keen and successful in their profession. Yet the one might very well exhibit great mechanical ability, be skilful with his hands, capable of doing well various kinds of mechanical work, deft in the use of tools and in his understanding of complicated mechanical conditions, while his colleague, lacking all these qualities, might compensate by great linguistic, musical, or artistic ability. There is no lack of mental activity or brain power in either case, simply a question of the mental type, of the direction of mental development, of the kind and acuteness of the perceptions. Now this same difference is to be observed, to a lesser degree but still productive of results, in any group of men attracted by similar mental trends to the study of a profession like medicine. To some the gaining of correct conceptions of form, of space-dimensions and relations, is intrinsically more difficult and requires more time and effort than to others, and this entirely independent of the retentive quality of memory and the permanence of impressions once acquired. It is quite evident that men of this type devote more time to direct object-study, and the school must make provision to enable them to do this in the best and most productive way.

In the second place, in any group of men gathered from various points for the common purpose of professional study, the individuals will differ in the kind and amount of special preliminary training received in anticipation of the work to follow. Many of you have enjoyed the advantage of the courses in chemistry, histology, embryology, zoology and general biology offered by the undergraduate institutions. Others among you have not had ac-

cess to these opportunities. Hence the courses of this school must be organized and administered to meet both conditions.

Let me take my own department as offering ample material for illustration, since your accurate knowledge of man's own structure is, of course, a prerequisite to all of your succeeding work, no matter how highly specialized it may become, and the same principles are involved in all other departments. This will, at the same time, enable us to estimate correctly the value and place in the educational plan of the text-book, lecture, recitation, conference, collateral reading, and other exercises of similar didactic character.

The great cardinal principle of sound natural object teaching and learning lies in the proper use of the object itself, in anatomy, therefore, of the human body. We are called upon to consider that body from all viewpoints, developmental and historical, structural and functional. We are bound to enlarge the scope of such study and enhance its value by all available collateral means bearing on the subject. We must treat not only of the bare morphological facts of normal structure, but interpret these facts in their functional adaptation to man's present environment, trace their phylogenetic history and man's relation in the general zoological series, value correctly the occurrence of human variants and interpret their significance understandingly. In short, our task is to afford the opportunity of gaining that complete insight into man's organization and its meaning which will enable you to take up the other problems depending thereon with a clear view and a well-defined purpose. In this endeavor the text-book, recitation, lecture, collateral reading and all other forms of didactic exercise occupy a definite, though in one sense, a subordinate position. They serve to furnish you with the systematic guide, to give the framework into which you are to fit the observations which your personal study of the object itself will yield. Theoretically you might reply, if study of the natural object itself is the only fruitful path to knowledge, that then the best results in anatomy would be attained by locking a man in a room with a cadaver, a knife, saw, chisel, and mallet, and telling him to find out as much as he can by personal observation in a given time. As a matter of

fact, a plan somewhat approaching this has been suggested and practiced. There are two valid objections to instruction of this kind. In the first place, it is adapted to only a very small percentage of the average class, the minority above referred to endowed naturally with very keen powers of mechanical observation and construction. Secondly, it requires an inordinate amount of time, which in the press of modern medical education and the constantly increasing demands of the graded course of study cannot be spared.

The plan, therefore, which best seems to conform to the practical conditions confronting us, is to offer a course adapted to the greatest number of students, and as economical as possible in its time demand, but sufficiently elastic to meet the varying individual requirements above referred to—a combination of practical personal work with a framework of systematic instruction to guide and direct this work to the best advantage.

The practical part of the instruction in anatomy consists, as you know, of work performed by the student individually in the courses of the dissecting-room. The main purpose here is to afford opportunity of rehearsing the didactic instruction by personal direct examination of the object, to corroborate and control mental concepts already acquired, to fix definitely impressions of structural relations by demonstration in the three dimensions of space. Incidentally, the technical and manual training in the use of the proper instruments is of value. Beyond this, the school offers, as complementary to both the didactic instruction and the practical individual laboratory work, under the caption of demonstrations and conferences, a mixed exercise in which a certain amount of systematic instruction is combined with the opportunity of directly examining and studying the natural object. This is the feature of the work to which I especially desire to direct your attention, because the proper utilization of the opportunities here offered will prove of distinct benefit to you, while at the same time it is easy to misunderstand the real purpose of the courses and to fail in attaining the best results from attending them. And remember that, while I am quoting the anatomical curriculum as an example, the same principle underlies the corresponding in-

struction offered by other departments. It makes no difference whether the object of your study is a selected series of morphological specimens or a correlated group of clinical cases. In both instances you are called upon to use your senses, to train your perceptive qualities, to gain definite impressions by direct personal observation and examination of the organic conditions presented to you. Hence in these exercises your chief interest should center in the material. The didactic instruction explanatory of and accompanying its presentation, is merely designed to direct your attention to the salient points of the demonstration without loss of time. The result, if successful, should be the acquisition, on your part, of a definite mental impression, which you will permanently retain as actual knowledge, which will be vividly recalled when in your text-books and in your general reading you encounter descriptions and illustrations of the topics involved, or when in your practical work you meet with identical or cognate and related conditions.

Now it is at this point, in this borderland between didactic and practical instruction, that the school can and should offer the greatest amount of direct help to you. It is perfectly sure that novel, unfamiliar, and perhaps unexpected structural, physiological or clinical conditions cannot always be readily grasped, entirely mastered and definitely retained during the course of an exercise addressed to a relatively large number of men, and covering an extensive field. The time allotted to each individual is limited, his examination of the material necessarily somewhat hurried, and he frequently fails in obtaining complete results. This is our constant experience in the anatomical courses, and we have for a number of years been actively engaged in strengthening this weak point in the course of study by the development of the absolutely necessary equipment for complementary self-study. This is where, in morphology, the museum in the modern sense appears as a most important educational factor, where in the clinical branches the assignment of students to definite terms in the hospital wards and out-patient departments, as clerks and surgical dressers, rounds out the educational plan of the general course of study.

Let me briefly outline the purpose of this form of instruction

from your standpoint, because it is often misunderstood. The lecture, demonstration, recitation or other exercise has carried you over certain definite ground. As many side-lights as possible have been perhaps thrown on the subject, but the impression remaining with you may be vague, in some details. Some important links may have escaped your attention entirely. The chain may be incomplete. Now is the time for you to round out this particular topic by repeated, leisurely, personal observation of the material itself, comparing it directly with your text-book accounts or notes. This in anatomy is the real function of the museum, properly organized. In it should be placed carefully selected and restricted preparations, serially arranged, carefully labelled, and accompanied by brief but sufficiently explicit descriptive tablets, accentuating the important points, and indicating the purpose of the preparation and its place in the series. This material should be made accessible, and proper time should be allowed in the arrangement of the course for its systematic use. It should represent the student's most valuable library of reference at first hand, in which he can control, if necessary correct, and firmly fix in his mind the impressions he has received in his other courses. Of course the acquisition of equipment of this kind is a matter of gradual growth —it exists nowhere ready made—and its instalment in a suitable locality, properly arranged, requires considerable time. But as far as such equipment exists here, and to the extent to which we hope to increase it during the year, I trust that you will use it as perhaps the most valuable single aid which the school is able to offer you in the prosecution of your work. But you will have to use it understandingly, with a very definite conception of what it is to yield and with a very definite purpose, in order to obtain its benefits. Nothing is a greater waste of time than the aimless wandering through a collection of natural objects, a vague and purposeless inspection of things which merely rouse a general curiosity. Each series should mean a *βρok* to you, each preparation a *page,* and you should so read and study that you know it by heart. For your best purposes, Agassiz's demand, "Study nature, not books" might well be enlarged to read "Study nature, and books in the light and by the aid of nature." Thus only, as

far as a school can do it, will you complete a satisfactory cycle of study in any given subject.

And now, in closing, let me ask you to consider just one more feature of this method of study, because it is one which so constantly intrudes itself that it is well to deal with it in this connection. You are members of a very arduous profession. The work put upon you as medical students is severe and most exacting, and it is natural to question whether much of it is not unnecessary as you are carried hour by hour throughout a long day from one course to another. After graduation you will undoubtedly enter and further develop in some one of the many departments into which the vast field of general medicine has of necessity become subdivided in the course of its scientific progress. Much, very much, of the information which you have acquired during your undergraduate course will be of little, if any, direct value to you. To the successful practitioner of midwifery the course and relations of the ulnar artery are matters of slight importance, nor will a detailed knowledge of the biliary and pancreatic ducts in their surgical import, be at all necessary to a specialist who confines himself to diseases of the throat and ear. But let me ask you to bear in this connection these things in mind:

1. Few, if any of you, can foretell into which particular path of professional activity inclination and opportunity will eventually lead you.

2. To thoroughly understand a whole knowledge of the components is an absolute prerequisite. A plumber's apprentice can probably wipe a water joint better than most professors of chemistry, but it would be a poor sanitary engineer whose accomplishments never went beyond that point.

3. Moreover, in the mutual interlocking of the multiple chemical, structural and physiological factors which go to make up the complex animal body, the correlation and interdependence of the individual parts is constantly becoming a more and more important matter as our knowledge advances. No element, however small and insignificant it may appear taken by itself, can safely be disregarded. I only need remind you of the parabranchial bodies, hardly considered worthy of detailed study or description a few

years ago, yet today occupying an important position in the pathology and therapy of tetany.

4. Lastly, and most importantly, the value of the technical training in observation cannot be overestimated. The deftness of touch, the manual dexterity, the acuteness of visual and aural perceptions, the ability to formulate correct deductions and general conclusions, acquired by the close application to the study of natural objects, will over and over pay for the energy expended, in whatever special branch of scientific work they are to be employed by you in the future, and so I say to you that you should not grudge the time or effort required in mastering the details of any of your courses, but regard them as proper preparation for your future successful life's work.

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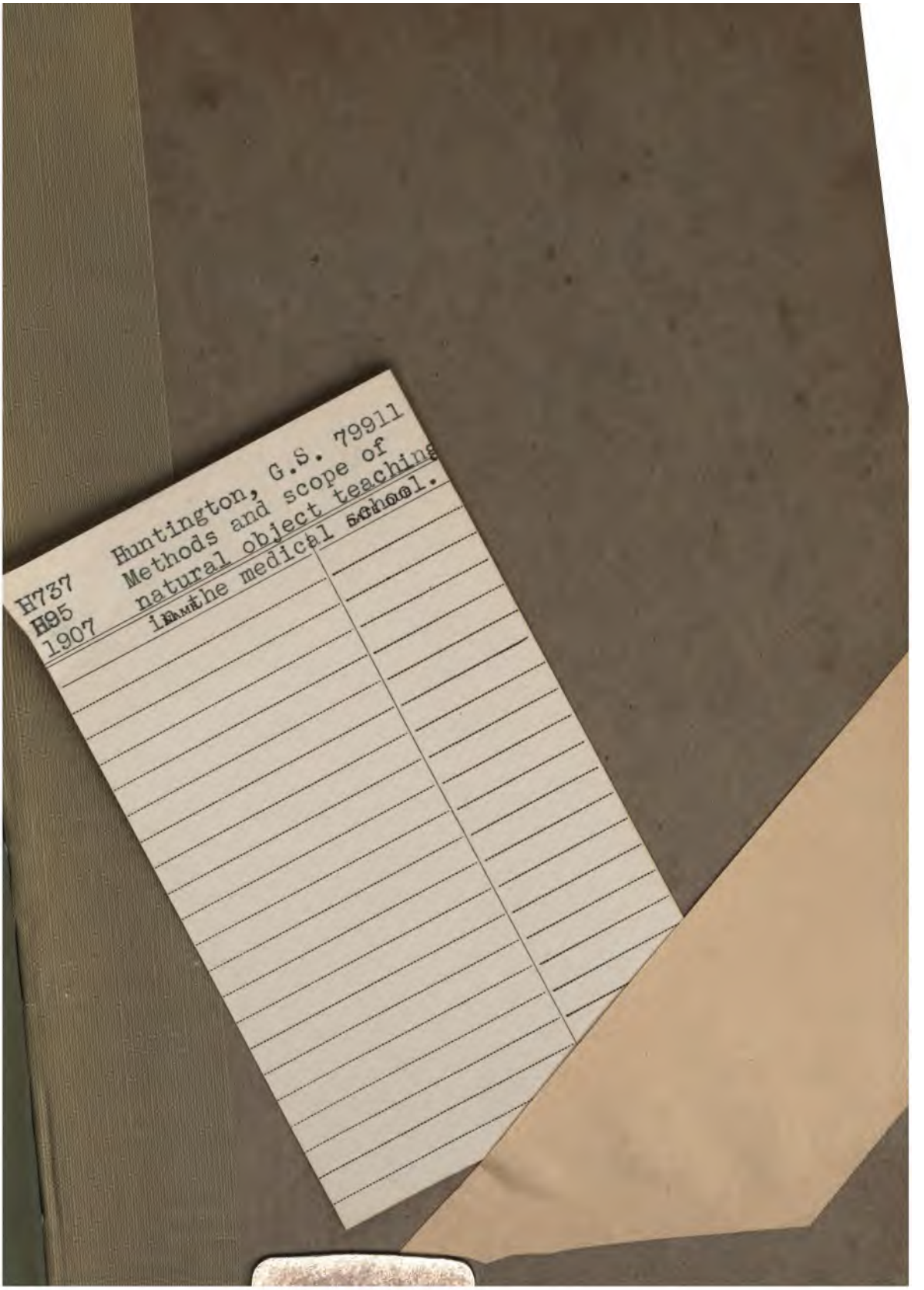
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